



Sulfonated Hydrocarbon Graft Architectures for Fuel Cell Membranes

Nielsen, Mads Møller; Jankova Atanasova, Katja ; Hvilsted, Søren

Publication date:
2012

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Nielsen, M. M., Jankova Atanasova, K., & Hvilsted, S. (2012). *Sulfonated Hydrocarbon Graft Architectures for Fuel Cell Membranes*. Abstract from 8th Annual Polymer Day, Kgs.Lyngby, Denmark.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Sulfonated Hydrocarbon Graft Architectures for Fuel Cell Membranes

Mads M. Nielsen¹, Katja Jankova¹, Søren Hvilsted¹

¹Danish Polymer Centre, Department of Chemical and Biochemical Engineering, Technical University of Denmark, Søtofts Plads, Building 227, DK-2800 Kgs. Lyngby, Denmark



Proton exchange membrane fuel cells (PEMFC) are gaining interest as an alternative power generator to the internal combustion engine, due to low potential energy loss, strongly reduced local pollution, and as a non-fossil fuel solution to the automotive industry. The technology is even more appealing in countries, like Denmark, where the primary storage of excess energy produced from renewable resources is that of electrolysis-generated hydrogen.

The electrochemical reaction between hydrogen and oxygen occurs over the polymer-based PEM. Important features of this include *i*) Proton conductivity, *ii*) chemical, mechanical and thermal stability under harsh conditions, and *iii*) gas impermeability. As the migration of protons takes place through ionic channels made up by e.g. sulfonic acid ($-\text{SO}_3\text{H}$) it is crucial to ensure the right balance between hydrophobic support and ionic ion conducting groups when designing PEMs.

Most commercial membranes are perfluorosulfonic acids (PFSA) but these suffer from drawbacks at elevated temperatures and are expensive to produce. Multiple different approaches are being applied in the search for an optimized PEM. For instance, research published on alternate graft systems comprises an aliphatic fluorinated backbone with sulfonated polystyrene (SPS) side chains¹ and a polysulfone (PSU) backbone with aromatic fluorinated side chains².

The present work is investigating a non-fluorinated graft system based on a PSU backbone with SPS side chains. The PS chains are clicked onto the PSU by the copper catalyzed azide-alkyne cycloaddition (CuAAC)³ and are subsequently sulfonated. Films are cast and evaluated from standard PEM parameters like proton conductivity, water uptake and ion exchange capacity (IEC).

¹ E. M. W. Tsang, Z. Zhang, A. C. C. Yang, Z. Shi, T. J. Peckham, R. Narimani, B. J. Frisken, S. Holdcroft, *Macromolecules* **2009**, 42, 9467–9480.

² I. Dimitrov, S. Takamuku, K. Jankova, P. Jannasch, S. Hvilsted, *Macromol. Rapid Commun.* **2012**, 33, 1368–1374.

³ S. Hvilsted, *Polym. Int.* **2012**, 61, 485-494.